



Response of onion (*Allium ascalonicum* L.) to the application of combination bioactivator formula of coffee leaves and hycinth liquid organic fertilizer fermented by *Trichoderma* sp.

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Abstract

This research is very important to be done to find out other alternative techniques of onion cultivation and develop community knowledge in the business of onion production in West Nusa Tenggara Province (NTB). The long-term goal of this research is to develop the potential of available local resources. Whereas the specific purpose of this study is that it is hoped that this research product can help improve the production of shallots on the island of Lombok and make the community able to explore organic local resources that are useful for agriculture. This study aims to determine the response of the growth of shallots given the combination formula of Bioactivator and liquid organic hyacinth fermented *Trichoderma* sp. This research was carried out in Sakra Village, East Lombok Regency. The research method used is an experimental method with experiments in the field. This study was designed using a single factor randomized block design (RBD) with 12 levels and 3 replications to obtain 36 experimental units. The collected data were analyzed using Regression analysis test. The results of the data analysis showed that the dose of 55 ml / liter is the best dose with the largest b value of 4.00 in the weight of fresh tuber parameter, supported also by the estimated value which is always positive and the P-value <0.05 and R Square tends to $\geq 80\%$, so it can be concluded that this product is very well used in the practice of onion cultivation on the island of Lombok.

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Introduction

Onion is one of commodities that have an economic value with a high level of consumption needs both as a medicinal plants and spices. Based on data provided by Pusdatin (2016), by 2015 Indonesia has import onion from India, Philippines, Taiwan and Viet Nam with a total weight at 17,428,750 tons. This figure indicates that the domestic demand of onion is greater than domestic production capacity. It was also reported that the projection of onion demand at 2019 will increase to 1,149,627 tons with the consumption level of 2.55 kg/capita/year (Pusdatin, 2015). Meanwhile, West Nusa Tenggara (NTB) Province is the forth highest of onion production centers in Indonesia after Central Java, East Java and West Java.

The productivity of onion in NTB is fluctuating. Based on Central Statistics Agency data (BPS, 2017), productivity of onion in NTB Province in the last five years were 8.19 tons/ha (year 2012), 10.95 tons/ha (year 2013), 10.20 tons/ha (year 2014), 11.03 tons/ha (year 2015), and 10.99 tons/ha (year 2016).

The decrease of onion production were caused by various factors including the way of onion cultivation that is not optimal (Hidayat *et al.*, 2010) and a lack of soil organic matter (Supriyadi, 2008).

Therefore, it is needed a solution effort to support improving soil quality through increasing soil organic matter content to achieve higher onion yield with low cost input production. So that, the onion imports can be reduced or even eliminated.

The alternative technology that can be used is emphasized on the organic farming cultivation by utilize local organic material waste that quite a lot available in NTB, such as Hyacinth and coffee leaves, which are able to improve soil quality and soil fertility, especially for onion cultivation field.

Based on the description above, it is necessary to conduct research to determine the usefulness and effect of giving organic leaf coffee product as

bioactivator and water hyacinth as a liquid organic fertilizer on the practice of onion cultivation on Lombok Island.

Materials and Methods

Location and Execution Time

The research which carried out at February until August 2018 was conducted in Sakra Village, East Lombok Regency, Nusa Tenggara Barat Province.

Equipments and Materials

The tools used were Laminar Air Flow Cabinet, autoclave, hot plate, water bath, petri dish, Erlenmeyer tube, beaker, measuring cup, test tube, pipette, knife, ose needle, Bunsen lamp, microscope, bucket, sprayer, scales analytic, meter, ruler, soil processing equipment and stationery.

The materials used were pure isolate of *Trichoderma* sp., coffee leaf litter, rice, hyacinth, brown sugar, gelatine, media PDG/A (*Potato Dextrose Gelatine/Agar*), alcohol, spritus, tissue paper, cling wrap, labels, plastic bags, aluminum foil, cotton, envelope, streptomycin, distilled water and onion seeds.

Research Stages

Experiment preparation and implementation

First of all, *Trichoderma* sp. obtained by isolation from the bamboo plant rhizosphere and then purified with Potato Dextrose Gelatine/Agar (PDG/A) media (Fig. 1).

The isolates were then multiplied on 10 kg of rice (Fig. 2). This fungus is used as an active ingredient in water hyacinth and bioactivator fermentation.

Bioactivator formulation was made using organic ingredients of coffee leaf powder and *Trichoderma* sp. Coffee leaf bioactivator (Fig. 3) was made by mixing coffee leaf powder with *Trichoderma* sp., And clean water with a ratio of 30 : 5 : 5 (30 kg of coffee leaves : 5 kg of *Trichoderma* sp. Solid media of rice : 5 liters of water clean) then fermented for 3 weeks at room temperature.

Water hyacinth liquid organic fertilizer (Fig. 4) is made by mixing 40 kg of solid water hyacinth that has been chopped, 5 kg of Trichoderma sp. medium of rice, 50 liters of clean water and 2 kg of brown sugar. All ingredients are put into a ferment at or bath and fermented for 20 days.

The combination of bioactivator and water hyacinth liquid organic fertilizer was made by mixing 50 liters of water hyacinth liquid organic fertilizer and 10 kg of coffee leaf bioactivator to produce a new formulation that is ready for application.

A total of 36 plots were made by formed the onion field with the plot size of 1 m x 2 m. Each plot was planted with 30 seeds of onion.

Then the combination bioactivator formula of coffee leaves and Hyacinth LOF-FT were applied and adjusted to the treatment dose. Pests and diseases control were carried out by spraying insecticides and weeding at every 7-days intervals.

Observation Variables

The variables observed included growth parameters ie. Plant height, number of leaves, weight of fresh plant, and weight of driedplant during the vegetative phase. Furthermore, observations were made on yield parameters which included the number of onion seedling, the number of tubers in the generative phase, the weight of fresh tubers, and the weight of dried tubers after harvesting.

Experimental design

This study was designed using a single factor experiment with Randomized Block Design (RBD). Factorsto be tested were Bioactivator combination formula and Hyacinth LOF-FT. The factor formed as liquid formulation was consist of 12 levels of dosages namely: P₀ = 0 ml/liter, P₁ = 5 ml/liter, P₂ = 10 ml/liter, P₃ = 15 ml/liter, P₄ = 20 ml/liter, P₅ = 25 ml/liter, P₆ = 30 ml/liter, P₇ = 35 ml/liter, P₈ = 40 ml/liter, P₉ = 45 ml/liter, P₁₀ = 50 ml/liter, P₁₁ = 55 ml/liter. Every treatment plot was replicated three times, so there were 36 treatment plots were obtained.

Data analysis

Data obtained were analyzed using regression analysis of SPSS Statistics Program Version 17.0, to obtain coefficient (b) variable x combination Bioactivator formula and Hyacinth LOF-FT. This b-value can be used to estimate the increasing or decreasing of onion productivity as in response to the treatment applied.

Results and Discussion

Results of onion growth parameter data analysis (Table 1) showed that the application of combination Bioactivator formula of coffee leaves and Hyacinth LOF-FT has a positive effect to the onion growth. This can be seen from the value of coefficient-b which is always positive and increases in line with increasing of plant age. Additionally, also known that is the weekly R² value tends to be above 0.8, which means that factor of Bioactivator combination formula gives a greater influence compared to the external factors.

Table 1. Data Analysis Result of the Regression on Onion Growth Parameters.

Plant Age	Data Analysis Result of the Regression on Onion Growth Parameter							
	Plant Height		Number of Leaves		Weight of Fresh Plant		Weight of Dried Plant	
	Value of b-coefficient	R Square	Value of b-coefficient	R Square	Value of b-coefficient	R Square	Value of b-coefficient	R Square
Week 1	0,041	0,73	0,034	0,78	0,036	0,86	0,004	0,85
Week 2	0,054	0,90	0,034	0,97	0,049	0,85	0,023	0,91
Week 3	0,059	0,74	0,054	0,64	0,145	0,84	0,044	0,93
Week 4	0,108	0,63	0,144	0,61	0,157	0,89	0,051	0,87
Week 5	0,110	0,88	0,153	0,90	0,381	0,79	0,095	0,92
Week 6	0,119	0,83	0,156	0,88	0,452	0,88	0,191	0,91

Note: Value of b-coefficient = value of estimated regression

R Square ≥ 0.8 = very good

R Square ≥ 0.7 = good

R Square ≥ 0.6 = pretty good.

The increasing of b-value has occurred continue sly along with the increasing of plant age which indicates the weekly increasing of nutrients and water absorption due to the influence to formula. Similarly, the R² value shows that this formula gave an effect above 80% to the weekly growth parameters of onion plant. It continues to occur along with increasing plant age.

Plant Height and Number of Leafs

Based on the results of data analysis that listed in Table 1, the b-value increases in line with plant age (Fig. 5). This shows that the plants treated by combination Bioactivator formula of coffee leafs and Hyacinth LOF-FT are significantly able to maintain and even to increase their growth rate,if they have compared with those which applied with a few amount or even not at all of combination Bioactivator formula of coffee leafs and Hyacinth LOF-FT.

Table 2. Result of Laboratories Content Analysis on Combination Bioactivator Formula of Coffee Leafs and Hyacinth LOF-FT and Soil Treated.

No	Parameters	Combination Formula of Bioactivator and Hyacinty LOF-FT	Soil treated with application of 55 ml/lit Combination Formula of Bioactivator and Hyacinty LOF-FT
1	pH	4,37	6,87
2	C-Organic	0,11 %	0,69 %
3	N-Total	0,11 %	0,08 %
4	C/N Ratio	1	-
5	P-Available	0,11%	166,29 ppm
6	CEC	-	27,83 cmol/kg
7	K	0,43%	5,08 cmol/kg
8	Ca	692,93 ppm	2,13 cmol/kg
9	Mg	2508,33 ppm	1,20 cmol/kg
10	Na	915,12 ppm	0,68 cmol/kg

Source: Result of Laboratories Analysis by BPTP Province NTB, 2018.

In addition, the positive b-value indicates that the combination Bioactivator formula of coffee leafs and Hyacinth LOF-FT has a positive impact to the onion growth. This is also showed by the R² value which tends to be greater than or equal to 0.8, which means

that the combination formula has greater affect than the external factors. The application of 1 ml/liter combination Bioactivator with the values produced, will increase plant height and number of leaves as much as b-value.

Table 3. Significance P-value Parameters of Onion Growth.

Plant Age	P-value			
	Plant Height	Number of Leafs	Weight of Fresh Plant	Weight of Dry Plant
Week 1	4 x 10 ⁻⁴	2 x 10 ⁻⁴	2 x 10 ⁻⁵	2 x 10 ⁻⁵
Week 2	2 x 10 ⁻⁶	1 x 10 ⁻⁸	2 x 10 ⁻⁵	2 x 10 ⁻⁶
Week 3	3 x 10 ⁻⁴	2 x 10 ⁻³	3 x 10 ⁻⁵	4 x 10 ⁻⁷
Week 4	2 x 10 ⁻³	3 x 10 ⁻³	3 x 10 ⁻⁶	1 x 10 ⁻⁵
Week 5	8 x 10 ⁻⁶	2 x 10 ⁻⁶	1 x 10 ⁻⁴	9 x 10 ⁻⁷
Week 6	4 x 10 ⁻⁵	8 x 10 ⁻⁶	6 x 10 ⁻⁶	2 x 10 ⁻⁶
Note :	P-value < alpha (0.05) = significance			
	P-value > alpha (0.05) = not significance			

This positive response occurs due to *Trichoderma* sp. contained in this formula can provide growth hormone (Suwahyono, 2003) while the Hyacinth LOF-FT which contains macro and micro nutrients (Renilaili, 2015) was able to support plant cell growth

(Stevenson, 1982). Result of research conducted by Apzani *et al.* (2017) showed that Hyacinth LOF-FT was able to increase the growth of lettuce on the island of Lombok.

Table 4. Data Analysis Result of the Onion Yield Parameters.

Result of Analysis on Onion Yield Parameters				
No	Parameters	Value of b-coefficient	R Square	P-value
1	Number of onion seedling	0,05	0,90	3×10^{-6}
2	Number of onion tuber	0,56	0,78	2×10^{-4}
3	Weight of fresh tuber	4,00	0,84	3×10^{-5}
4	Weight of Dried storage tuber	2,76	0,86	1×10^{-5}

Note: Value of b-coefficient= value of estimated regression

R Square ≥ 0.8 = very good

R Square ≥ 0.7 = good

R Square ≥ 0.6 = pretty good

P-value < alpha (0.05) = significance

P-value > alpha (0.05) = not significance

Kristanto *et al.* (2003) stated that Hyacinth contains a large amount of nitrogen (N) which are able to substitute Urea fertilizer. Based on the result of laboratory analysis conducted by BPTP, nutrients content of Hyacinth LOF-FT are listed at Table 2.

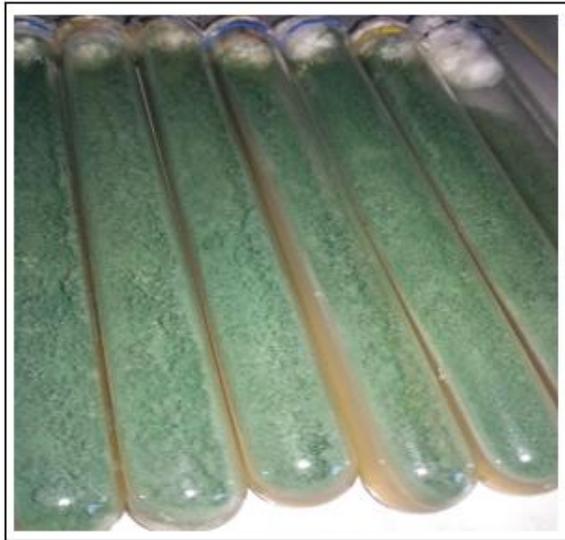


Fig. 1. Purification of *Trichoderma* sp. with Potato Dextrose Gelatine/Agar (PDG/A) Media.

In this table can be seen that Nitrogen content of Hyacinth LOF-FT as much as 0.11% which was available for plant. Nitrogen assists the formation of

proteins and enzymes that play a role in metabolism that supports to the plant height and number leaves to become component of plant biomass. In the condition that plant fall on nutrient deficiencies, the plant growth will be disrupted then the plant will be yellow and stunted (Moeskop, 2007).



Fig. 2. Replication of *Trichoderma* sp. with Rice Media.

Enhancement of plant growth and plant development are influenced by external and internal factors.

External factors such as the environment greatly affect to the plant growth, especially the availability of nutrients in the soil. The fertile soil will have a great effect on plant growth. If the soil contains enough nutrients, the plant will also respond by providing good growth and vice versa. The available of essential nutrients in this formula product are the main indicators that will determine its influence to support the growth and yield of onion.



Fig. 3. Bioactivator of coffee leaf powder that has been fermented with *Trichoderma* sp.

The increase of onion plant height is caused by the ability of the fungus *Trichoderma* sp. to do colonization and symbiosis quickly so that the its population increases in the onion rhizosphere. This will lead the plant grow up as in line with the number of exudates produced. The results of the study conducted by Apzani *et al.* (2015) showed that *Trichoderma* sp. contained in biocompost was able to an increase the height of corn plants on dry land. *Trichoderma* sp. are able to produce hormones, especially auxin, gibberelin and ethylene (Sudantha, 2010). This hormones function in the formation and elongation of the stem (onion leaves). In addition, *Trichoderma* sp. also has the ability to decompose organic matter into simpler minerals to be available for plants.

The combination Bioactivator formula of Coffee Leaves and Hyacinth LOF-FT also contain organic acids which are characterized by a low pH, 4.37.

These organic acids can help in providing plant nutrients. As stated by Mahbub *et al.* (2009), these organic acids can form stable organ metal complex compounds with several metals such as Cu^{2+} , Mn^{2+} , and Zn^{2+} so that nutrients can be released in the form of NH_4^+ , PO_4^{3-} , and SO_4^{2-} and are easily absorbed by plants. Organic acids such as fulvic and humic acids derived from fermented organic matter (Sham, 2008), function as carriers of micro elements from surface of roots into plant tissues, and can stimulate root development (Suwahyono, 2011). Humic acid and fulvic acid also has an ability to hold a quite high water, which is about 20 times its own mass which provides soil humidity (Stevenson, 1982).



Fig. 4. Hyacinth Liquid Organic Fertilizer Fermented by *Trichoderma* sp. (LOF-FT).

In Table 3, it can be seen that the P-value obtained is lower than the alpha value (<0.05). This means that the application of the combination bioactivator formula of coffee leaves and Hyacinth LOF-FT give a significant influence. P-value is used to determine the significance of b-value in Table 1. In this way the b-value of parameter growth can be used as a valid estimation value.

Weight of Fresh Plant and Weight of Dried Plant

Plant weight after harvest is a reflection of the ability of plants to absorb nutrients during the plant growth and plant development.

The weight of fresh plants shows the efficiency of plants in absorbing water and is an accumulation of various assimilations that have been produced by single parts of plants (Pujiasmanto *et al.*, 2010). Weight of dried plant dry can be used as a reference in observing the net results of assimilate stockpiling such as carbohydrates, proteins, fats and plant nutrients during the plant growth and plant development (Simanjuntak, 2000).

Based on the results of data analysis, it can be seen that the combination formula of Bioactivator and Hyacinth LOF-FT at dose of 55 ml/liter, gives the highest b-value and affects significantly on increasing

weight of fresh plant and dried plants within period of vegetative phase. This can be seen through the coefficient of b-value which shows a positive result of 0.452 with the influence (R^2) at 88% for fresh weight and b-value of 0.191 with influence (R^2) at 91% for the dried weight of plants. This value is strengthened by the P-values of $6 \times 10^{-6} < 0.05$ and $2 \times 10^{-6} < 0.05$, respectively, that indicates the treatment is able to increase the weight of fresh plant and weight of dried plant for every application of 1 ml/liter combination formula.

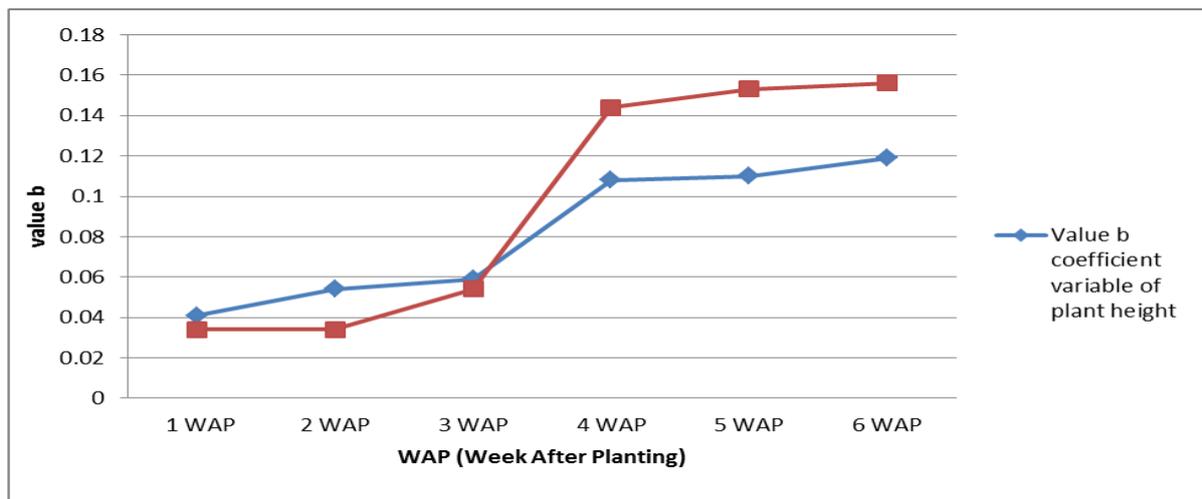


Fig. 5. Graph of The Increasing of Plant Height and Number of Leafs at Vegetative Phase.

The increase of fresh plant and dried plant weight are caused by the availability of nutrients such as phosphorus (P) (0.11%) and potassium (K) (0.43%) (See Table 2) derived from the decomposition of Hyacinth LOF-FT and coffee leaves. Phosphorus plays a role in the translocation process resulted by assimilation, storing and transferring energy from photosynthesis that are utilized in the metabolic processes of plants (Liferdi, 2010).

It was also reported that organic acids as result from the decomposition process of Hyacinth LOF-FT and coffee leaves were also able to accelerate the release of potassium ions which are bound to soil metals, resulting in the availability of large amounts of potassium both from this formula and potassium release from colloidal soil. Potassium functions to increase the metabolism of plants and make plants

resistant to drought so that the development of plants are better (Novizan, 2002).

Furthermore, Suntoro (2003) states that organic acids can stimulate plant growth by accelerating cell division which in turn can increase plant weight. Increasing the wet and dry weight of the plant (Fig. 6) on a weekly basis shows that the plants treated with this formula show faster growth, because the value of b takes into account the distance of data obtained each week during the vegetative phase

Bintang and Lahudin (2007) stated that nutrients can be optimally available for plants if the soil is at a pH around neutral (6.5-7.5). If the soil pH is in acidic conditions, nutrient availability decreases because nutrients are tightly bound by acidic cations so that nutrients become unavailable to plants.

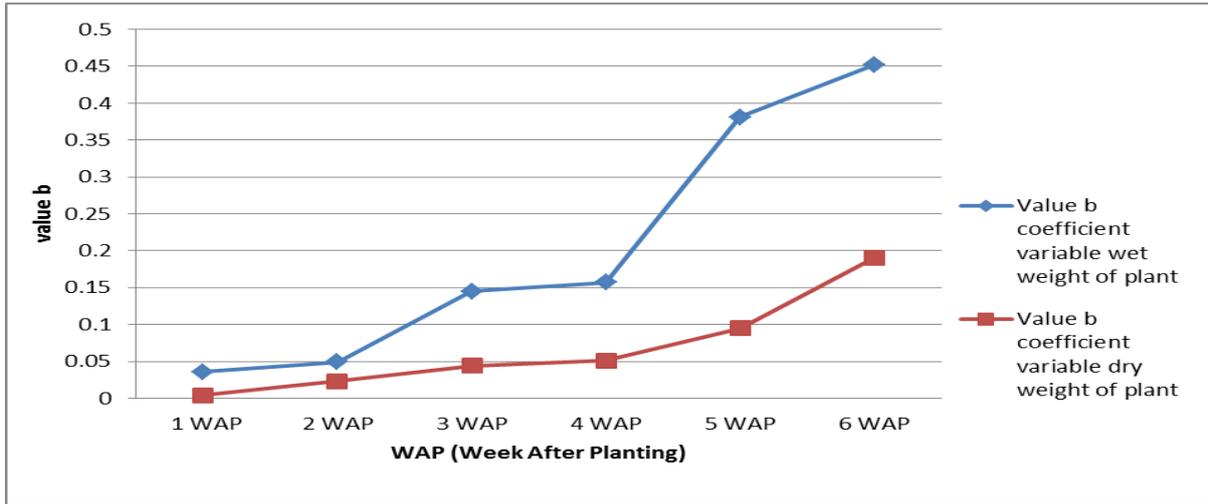


Fig. 6. The Increasing of Fresh Plant Height and Enhancement of Dried Plant Weight in period of Vegetative Phase.

The bioactivator and liquid organic fertilizer combination formula for water hyacinth is able to stabilize the soil pH of 6.87 (Table 2) so that nutrients can be available to plants.

The increasing soil pH is also affects to the activity of *Trichoderma* sp. which can indirectly increases metabolic outcomes such as biomass for the formation of fresh and dry plant weight (Lingga and Marsono, 2005).

Table 4 shows the results of onion yield parameter analysis of the onion.

The coefficient values of b, R² and P-value are the main indicators of the effect of combination Bioactivator formulas of coffee leaves and Hyacinth LOF-FT treatments to the plant growth. Those values can be use to be considered whether the result of this research could be be applied to the practice of onion cultivation on Lombok or not.

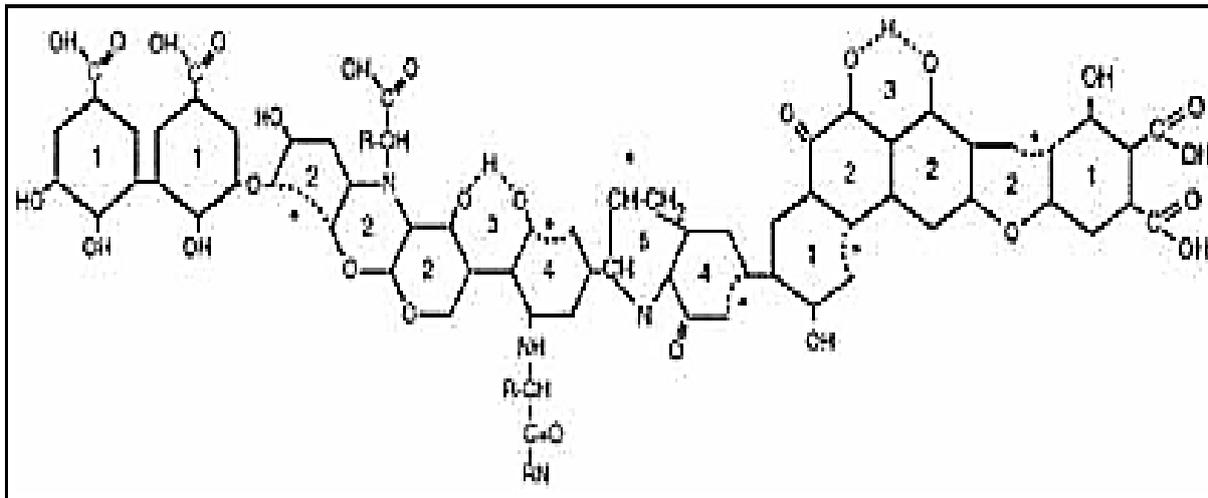


Fig. 7. Phenolik Group (-OH) on the Molecular Structure of Humic Acid (Suwahyono, 2011).

Table 4 showed that results of data analysis on the parameters of onion growth have a significant effect to the number of seedling, number of tubers, weight of fresh tubers and weight of dried tubers. In those yield parameter, the coefficient b-value has always

positive value, and the R² value tends to be greater than or equal to 0.8 while the P-value is lower than 0.05. This means that formula products are able to increase the onion yield.

In table 4, the largest b-value (4.00) is achieved by the weight of fresh tuber after harvest. It means that in every application of 1 ml/liter Bioactivator combination formula and Hyacinth LOF-FT will be able to increase the weight of fresh tuber as much as 4.00 grams. Meanwhile, the lowest b-value at 0.05 is achieved by the number of onion seedling as an initial process of generative growth. This indicates that in every application of 1 ml/liter Bioactivator combination formula and Hyacinth LOF-FT will be able to increase number of seedlings as much as 0.05 seed.

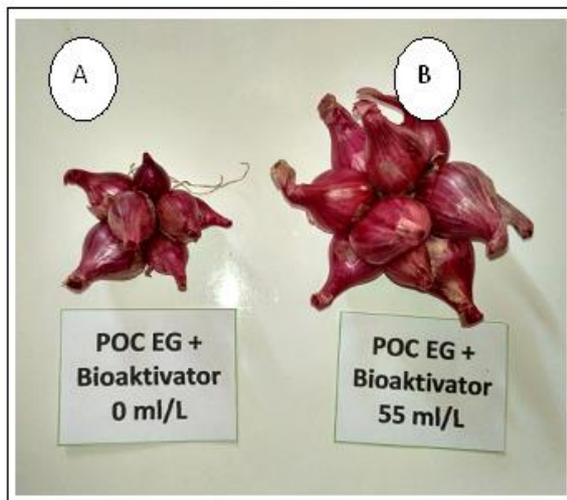


Fig. 8. Visualization between Onion Plant Treated by Combination Bioactivator Formula at 55 ml/l (B) and Untreated Onion Plant (A).

Number of Seedling and Number Tuber

Based on the results of regression analysis that has been done, it can be seen that the treatment of combination formula of Bioactivator and Hyacinth LOF-FT has a positive effect to the parameters number of seedling and number of onion tuber. Table 4 shows that the addition of 1 ml/liter of this combination formula will able to increase the number of seeds as much of 0.05 seed and the number of tubers as much as 0.56 tubers. On the number of seedling parameters, P-value and R^2 values are 3×10^{-6} and 0.90 respectively. Likewise, with the number of tuber parameters, the P-value and R^2 values are 2×10^{-4} and 0.78, respectively.

This indicates that the value of the b-coefficient x obtained is significant and is suitable to be an

estimate of the increase number of seedling and number of tubers. The increasing of number of seedling and number of tubers is affected by combination formula of Bioactivator and Hyacinth LOF-FT. Besides, the *Trichoderma* sp. containing in the combination formula is useful for the generative phase of the plant growth due to the secretion of gibberelin hormone. Gibberelin hormone is bioactivator which also made from coffee leaves fermented by *Trichoderma* sp. which contains phenolic compounds (-OH) (Wistiana and Zubaidah, 2015). Phenolic (-OH) is a functional group of humic acid (Fig. 7) which is the result of organic matter decomposition (Sham, 2008).

Phenolic plays a role in increasing soil cation exchange capacity (CEC) (Suntoro, 2003) which is very important in nutrient retention to avoid leaching. As the results of soil analysis (Table 2), soil treated by combination Bioactivator formula of Coffee Leaves and Hyacinth LOF-FT has a CEC of 27.83 cmol/kg, in which able to provide soil nutrients for plants. Phenolic groups are a source of negative charge (Brady, 1990) which can contribute the soil nutrients absorption that are positively charged and released again when saturation occurs in the soil colloids. Nutrients that have been released are then absorbed through the flow of simplas and amyloplas by the roots (Haryanti *et al.*, 2009) which are then assembled together with the compound $C_6H_{12}O_6$ as a result of photosynthesis to be used as various functional proteins, and structural proteins that support the growth of seedlings and onion tubers.

Weight of Fresh Tuber and Dried Storage Tuber

Based on the data analysis that has been carried out, it can be seen that the combination Bioactivator formula of Coffee Leaves and Hyacinth LOF-FT has a positive and significant effect on fresh tuber weight and on dried tubers weight. This can be seen from Table 4, as indicator values of increasing or decreasing onion yield. Coefficient b-value b (Table 4) of fresh tubers weight and dried tuber weight were 4.00 and 2.76, respectively, indicated the positive values.

The treatment formula that was given to the plan had an effect (R^2) on fresh tubers weight and dried tubers weight at 84% and 86% and the P-value was 3×10^{-5} and 1×10^{-5} , smaller than the alpha value.

With the similar interpretation of the results of the data analysis to be discussed previously, these values indicate that the treatment of combination Bioaktivator formula of Coffee Leafs and Hyacinth

LOF-FT was able to increase the fresh tubers weight by 4.0 g and 2.76 gr for dried storage tuber weight at every 1 ml/liter formula application. Whereas the P-value indicates that the treatment of this formula gives significant results on increasing the fresh tubers weight and dried storage tubers weight.



Fig. 9. Comparative Visualization of the Tuber Growth at every dose of Combination Bioaktivator Formula.

These can also be seen in the visualization of the difference in tuber size at dose of combination formula 55 ml/liter application compared to the untreated plant (Fig. 8) and Comparative Visualization of the Tuber Growth at every dose of Combination Bioaktivator Formula (Fig. 9).

The increase of those tubers weight is influenced by the nutrient content as well as the population of *Trichoderma* sp. which is contribute to the onion growth. As stated by Salisbury and Ross (1995), fungi reproduced in the soil are able to produce growth hormones that will lead to the physiological responses to enhance the generative development of plants, even at very low concentrations. But if the population of *Trichoderma* sp. in the soil exaggerate then it will poisoning plants (Herlina, 2009).

The difference in the development of onion tubers in the picture above shows the success of combination formula application. The formula produced in this study contains hormones needed for tuber growth. As stated by Mariani and Musleh (2017), *Trichoderma* sp. is able to accelerate plants growth by producing hormones such as gibberellic acid (GA₃). It was also reported that *Trichoderma* sp. are able to produce indolacetic acid (IAA) of 9,656 μM (Ramadhani, 2007) which causes plant growth to be more optimal, fertile, healthy and sturdy so that it affects the filling of onion tuber. Indolic acid works by pumping H^+ ions into the cell wall and making the cell wall acidic (Wijayati *et al.*, 2005).

This will activate the enzyme to cut the cellulose cell wall bond (Lakitan, 1996), so that the water that has been absorbed by the root can enter through the open cell wall. Furthermore, nutrients absorbed through the simplas and amyloplast streams (Haryanti *et al.*, 2009) will be carried through the xylem toward ribosome to be assembled into structural proteins (Winarni *et al.*, 2015) as a form of assimilation. Then the assimilate is carried through the vascular phloem into the cell to be assembled into cell organelles (Muna, 2012), so that the cell continues to grow and develop due to the entry of water and the synthesis of new cell organelles. And so, this will impact to the development of onion tubers.

This metabolism must be supported by an appropriate pH condition (6.5-7.5) in the cell (Nurida and Rahman, 2012) and sufficient nutrient availability in soil, then that cell differentiation becomes faster and more perfect to increase the weight and the volume of tubers (Lingga and Marsono, 2005).

The completeness of nutrient content that is useful in fostering biomass, the presence of organic acid compounds that play an active role in the release of nutrients in the soil, the ability to maintain soil pH for root metabolism, the ability of soil CEC to be good enough to absorb nutrients to prevent nutrient deficit, the content of growth hormone, and vitamins as a fermentation product and that is useful as catalysts in cell division, all of those factors bring about this combination formula product is the right choice in cultivation techniques to increase onion productivity on the island of Lombok. In addition, this formula can also affect soil elasticity due to the formation of granules by organic matter that bind clay so that the soil becomes more porous (Suntoro, 2003). As a result, the soil can be penetrated easily by roots and onion tuber are able to grow bigger.

Conclusion

Based on the research that has been done, it can be concluded that the combination formula of bioactivator and LOF-FT dose of 55 ml/liter gives the best results with the highest b value is 4.00 in the weight of fresh tuber parameter.

This formula has a significant influence on the growth and yield of shallots so that it can be applied to the practices of onion cultivation on the island of Lombok. With the best dose that is fairly high, it is recommended to combine the formula with other organic ingredients to obtain a lower optimal dose.

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